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Committee on the Peaceful Uses of Outer Space

International cooperation in the peaceful uses of outer space: activities of Member States

Note by the Secretariat*

Addendum

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* The present document contains replies received from Member States between 1 December 2000 and 16 January 2001.

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I. Introduction

1. In the report of its forty-third session,[1] the Committee on the Peaceful Uses of Outer Space agreed that the Scientific and Technical Subcommittee should consider an agenda item entitled "General exchange of views and introduction to reports submitted on national activities". In its resolution 54/67 of 6 December 1999, the General Assembly endorsed the recommendation of the Committee[2] that the Secretariat invite Member States to submit annual reports on their space activities. In addition to information on national and international space programmes, the reports could include information on spin-off benefits of space activities and other topics requested by the Committee and its subsidiary bodies.

2. Information received by Member States as at 30 November 2000 is contained in the note by the Secretariat of 4 December 2000 (A/AC.105/752). The present document contains information submitted by Member States between 1 December 2000 and 16 January 2001.

II. Replies received from Member States

Germany

Space activities in Germany are described in the Annual Report of the German Aerospace Centre (DLR), to be distributed at the thirty-eighth session of the Scientific and Technical Subcommittee, from 12 to 23 February 2001.

Indonesia

A. Introduction

1. Indonesia is a sprawling archipelago with more than 17,000 islands, large and small, some adorned with volcanic mountains, others flat and marshy, spreading out along one eighth of the Equator and covering an area of some 1.9 million sq km of land, 3.1 million sq km of territorial sea and a 2.7 million sq km exclusive economic zone. With all its specific conditions and its geographical location, Indonesia is the only maritime country in the world with a unique behaviour that affects the global climate.

2. Owing to its specific conditions and geographical location, Indonesia views space technology and its applications as a powerful and efficient tool that can make a significant contribution to solving the multitude of development problems confronting the country. This was the main reason why Indonesia embarked on its space activities in the early 1960s. The emphasis of national space activities relevant to national development has been placed on the application of space technology to enhance the welfare of all Indonesian people and on other space-related efforts required for the sustainability of such activities.

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[1] *Official Records of the General Assembly, Fifty-fifth Session, Supplement No. 20* (A/55/20), para. 119.

[2] Ibid., *Fifty-fourth Session, Supplement No. 20 and corrigendum* (A/54/20 and Corr.1), para. 119.

B. Organization

3. Space-related activities in the country are conducted by various departments and agencies. The National Institute of Aeronautics and Space (LAPAN) acts as a national focal point in conducting research and development related to the peaceful uses of outer space. LAPAN is directly responsible to the President of Indonesia, while its activities are technically coordinated by the Ministry of State for Research and Technology. The National Space Policy and Plan are formulated by the National Council for Aeronautics and Space of the Republic of Indonesia. The Council, chaired by the President of Indonesia, also acts as the highest coordination body for all space activities in the country.

C. Activities and accomplishments

1. Telecommunications

4. At present, six satellites—two satellites of the Palapa B series, one of the Palapa C series, Indostar-1 (also known as Cakrawarta-1), Telkom-1 and Garuda-1—are being operated by state-owned and private companies for the purpose of fixed telecommunications, broadcasting and mobile telecommunications. Garuda-1, launched in February 2000, is one of the most powerful geosynchronous satellites ever built for commercial use for global mobile personal telecommunications. The service area of Garuda-1 extends from India and Pakistan in the west to Papua New Guinea and the Philippines in the east, and from China and Japan in the north down to Indonesia in the south. Garuda-1 is owned jointly by PT Pacific Satelit Nusantara, the first private satellite telecommunication company in Indonesia, Lockheed-Martin Global Telecommunications of the United States of America, the Philippines Long Distance Telephone Company and Jasmine International Public Company Limited of Thailand.

5. The operation of telecommunications satellites, which has made a big leap in serving the country's telecommunications needs, has also driven the growth of various telecommunications industries in Indonesia, such as transmission equipment, cable and exchange/switching industries. The initiative to launch telecommunications satellite systems not only supports telecommunications infrastructure development, but also creates strategic value in social, economic, educational and cultural aspects.

2. Remote sensing applications: Earth and the environment

6. Many organizations, institutes and industries in Indonesia are active in remote sensing. Based on its functions, LAPAN acts as the national focal point in research and development of the utilization of remote sensing satellite data. In that context, LAPAN has been operating the remote sensing ground station system as well as other facilities for remote sensing satellite data applications. Other national agencies, among them the National Coordination Agency for Surveying and Mapping (Bakosurtanal), the Meteorological and Geophysical Agency (BMG), the Agency for the Assessment and Application of Technology (BPPT), the Indonesian Institute of Sciences (LIPI), the Ministry for Public Works, the Ministry for Forestry and the Ministry of State for Life Environment, have also installed data-processing

facilities corresponding to their needs. Institutes of higher learning, including the University of Gadjah Mada (UGM) and Bogor Agriculture Institute, have established and carried out an education and training programme in remote sensing aimed at developing students as both scholars and skilled practitioners in the applications of remote sensing satellite data. A number of private companies have also been involved in providing satellite data and the involvement of such companies will continue to increase.

7. Starting in the year 2000, LAPAN has upgraded the existing multi-mission ground receiving station located at Parepare, south Sulawesi. The upgrading was completed at the end of October 2000 and the station is now able to acquire Landsat 7 data.

8. In furtherance of remote sensing activities in Indonesia, LAPAN has been conducting research and development in remote sensing technology and applications as well as training and education for user agencies. In the field of remote sensing technology, attention is given mostly to the ground segment. Some activities that have been performed by LAPAN include (a) engineering design of an acquisition system for a low-bit-rate satellite; (b) designing and establishing a PC-based image-processing prototype (32 bits for a single user and 64 bits for multiple users); and (c) study of future satellite technology trends and direct data capture.

9. Applications of remote sensing data in Indonesia are based on satellite imagery of the Earth and the environment acquired by LAPAN ground stations. Data or information derived from satellite imagery have been used for various scientific and operational applications such as (a) inventory of irrigated rice fields; (b) forest mapping and monitoring; (c) mangrove forest inventory; (d) coral reef mapping; (e) mapping of sea surface temperature; (f) forest fire detection and monitoring; (g) drought monitoring; (h) Inter-Tropical Convergence Zone monitoring and cloud cover mapping; (i) outgoing long-wave radiation mapping and monitoring; (j) flood monitoring and flood susceptibility assessment; and (k) identification of potential fishing zones.

3. Research and observations of the atmosphere and ionosphere

10. The main institute undertaking activities related to research and observations of the atmosphere and ionosphere/upper atmosphere is LAPAN. Its research and observations are intended to enhance the use of existing space technology for various fields of application as well as to understand the natural phenomena and specifications of the atmosphere and ionosphere/upper atmosphere in relation to Indonesian climate prediction and environmental conditions.

(a) Research and modelling of the Indonesian climate

11. The climate research programme in Indonesia is intended to provide scientific insight into the causes and effects of changes in and variability of climate systems on global, regional and local scales. It also serves as a basis for developing tools for assessing options for responding to climate change and variability. With the increase in understanding of those systems and their feedback mechanisms, the scientific outcomes would certainly provide increasingly valuable input to support national, regional and international policy decisions, as well as input for evaluating the impact and effectiveness of those decisions.

12. Activities related to research and modelling of the Indonesian climate are performed within five programmes:

(a) *Atmospheric processes*. The atmospheric processes programme aims to improve knowledge of dynamic systems, radiation balance (the interaction of radiation with clouds and the Earth's surface and the way in which water vapour affects climate), cloud formation and cloud cover, precipitation, transpiration and evaporation, the hydrological cycle, atmospheric dynamics on micro-, meso- and macro-scales, ocean-atmosphere interactions and the role of the equatorial atmosphere;

(b) *Biogeochemical processes (including atmospheric pollution)*. The biogeochemical processes programme is studying many aspects of greenhouse gases as well as factors that influence urban and regional air quality, focusing on identifying sources of pollution and studying the way in which it is formed, transported and dispersed. Based on a model constructed by the Australian Commonwealth Scientific and Industrial Research Organization (CSIRO), a Lagrangian atmospheric dispersion model has been developed that can be used to describe dispersion of pollution in a number of cities in Indonesia;

(c) *Solar-terrestrial relationships*. Research on solar-terrestrial relationships focuses on the effects of solar variability on the atmosphere, biosphere and the Earth's surface and on the response of the middle atmosphere to lower- and upper-forcing and to mass and energy transfer in the middle and upper atmosphere. The programme also gives attention to the physics of the Sun as the main source of the energy and disturbances in the Earth's atmosphere;

(d) *Climate modelling, simulation, prediction and scenarios*. The climate modelling programme is aimed at developing powerful computer climate models of the atmosphere. Ocean-atmosphere-land-biosphere interactions are formulated and integrated into models. Those models are used to investigate climate variability, climate change associated with an enhanced greenhouse effect and the likely impact on climate change and variability. LAPAN recently installed a range of climate modelling facilities, which include an atmospheric and ocean global circulation model and a limited area model developed by the CSIRO Division of Atmospheric Research. The model is the basis for studies, assessment and development of an appropriate model in accordance with Indonesian characteristics;

(e) *Climate data and information system*. A large amount of climate-related data is obtained by a number of institutes in Indonesia (mainly BMG, LAPAN, BPPT, Bakosurtanal and LIPI), as well as by a number of foreign institutions. A system that links and integrates the existing database is now under development.

(b) Research and observation of the ionosphere and upper atmosphere

13. Indonesia is located within the ionospheric equatorial anomaly region, which provides a good opportunity to investigate the behaviour of low-latitude ionospheric phenomena. Ionospheric research is important not only for understanding the physics of the upper atmosphere, but also for ionospheric radio propagation. For those purposes, an ionospheric sounding network consisting of six digital ionosondes has been established in Indonesia. Digital ionosonde data provided every minute with high time-resolution digital ionograms will be available. Those high-resolution ionograms will provide useful information on ionospheric dynamics

and ionospheric irregularities and for high-frequency (HF) radio communication. Ionospheric vertical sounding observations covering one solar cycle are used to develop a model of HF radio communication prediction. Through collaboration between Australia and Indonesia, the accuracy of frequency prediction has been improved using real-time frequency management. That activity is supported by an oblique sounding system.

14. To investigate varying phenomena such as the effects of geomagnetic storms and magnetic micro-pulsations on the ionosphere, a network of geomagnetic observations consisting of fluxgate magnometers has been established in Indonesia. Variations in the Earth's magnetic field and geomagnetic pulsations can now be routinely monitored. Indonesia is at present participating in a western Pacific project to develop a forecasting capability for the occurrence and severity of equatorial spread-*F* (ESF) on a day-to-day timescale. The goal of the western Pacific project is to obtain a comprehensive set of measurements, including the electric field and the plasma density distribution along a magnetic meridian plane, in both hemispheres.

15. In order to study the effect of the ionosphere on the reception of signals from satellites, total electron content and scintillation data deduced from Global Positioning System (GPS) and navy navigational satellite system (NNSS) satellites have been used with applications to the physical modelling of total electron content and scintillation effects. The signals from GPS and NNSS satellites are being used to provide group delay and differential phase information as well as the total electron content and scintillation.

16. Through collaboration since 1995 between Australia, Indonesia and Japan, a multi-frequency radar (MFR) has been established at Pontianak (0.03° S, 109.33° E) for measurements of atmospheric dynamics in the equatorial mesosphere and lower thermosphere. Recent studies revealed that a better understanding of the global structure of atmospheric dynamics requires more information on subjects such as momentum flux and horizontal motion of the middle thermosphere. To that end, the MFR will be replaced with a new MFR located in the same place. In addition, airglow imager observations have been conducted since October 2000 at Tanjungsari (6.90° S, 107.50° E), West Java.

4. Global positioning system applications

17. Since 1996, GPS has been the tool in the re-establishment of the national Geodetic Datum and Reference System. Indonesia adopted WGS-84 reference ellipsoid parameters for the new Indonesian national spheroid to replace GRS-67.

18. Up to October 2000, Indonesia, through Bakosurtanal, had established 550 geodetic reference points of zero- and first-order specification, while more than 10,000 geodetic control points of second- and third-order specification had been established by the National Land Agency in cooperation with Bakosurtanal, Bandung Institute of Technology and UGM.

19. From 1996 to 1999, six differential GPS permanent tracking stations had been used for the operation of the digital marine resource mapping project.

20. For the purpose of precise geodetic and geophysical application, Bakosurtanal established six permanent geodetic GPS stations located in Cibinong, Medan,

Parepare, Tolitoli, Kupang and Biak. Those stations are part of a total of 12 stations designed to constitute the Indonesian Permanent GPS Station Network (IPGSN). The development and operation of the network is supported by the Scripps Institution of Oceanography (SIO) of the University of California at San Diego, United States of America, the École normale supérieure (ENS), Paris, and Delft University of Technology (DUT) in the Netherlands. The Cibinong and Medan stations are also part of the Indonesian contribution to the International GPS Geodynamics Services of the International Association of Geodesy programme.

21. At the end of 2000, Bakosurtanal will establish a high-rate GPS permanent tracking station in Yogyakarta for the purpose of monitoring the orbit of the challenging mini-satellite payload (CHAMP) mission as well as for monitoring Merapi volcanic activities. The plan will be supported by the GeoForschungsZentrum (GFZ) of Germany and will be operated by the UGM Department of Geodesy.

22. Regarding GPS applications for geodynamic studies in Indonesia, in particular plate tectonic motion, Bakosurtanal and related agencies of Indonesia, in cooperation with the Bundesamt für Kartographie und Geodäsie and GFZ of Germany, SIO and Rensselaer Polytechnic Institute of the United States, ENS of France, DUT of the Netherlands, the Australian Surveying and Land Information Group and the University of New South Wales of Australia, the Department of Standards Malaysia and the University of Technology Malaysia, the Royal Survey of Thailand, the National Mapping and Resource Information Authority of the Philippines, Nanyang Technological University of Singapore, the Survey Department of Viet Nam and the Department of Public Works of Brunei Darussalam, have carried out several GPS campaigns in the south-east Asian region as well as in the Indonesian region. Target areas include the Sumatran Fault, the Sunda Strait, the Java Subduction Zone, the Sulawesi Triple Junction, the Flores Fault and the Sorong Fault.

5. Space technology development

23. Activities related to space technology development have stressed indigenous design and development of systems and/or subsystems. These include systems for guidance and control, sounding rocket mechanisms and structures, development and testing of propellant raw materials and solid propellant, space vehicle payload telemetry technology, data communication technology and low-Earth orbit tracking technology. LAPAN, as the main institute in the country carrying out space technology development, is now developing standardized rockets for the purpose of research dealing with middle and upper atmosphere physics.

24. Space technology development will accelerate within available resources in order to catch up or at least keep pace with the fast-growing world of space. In that regard, Indonesia among others is now giving attention to the possibility of small satellite development intended for various applications.

6. Studies of socio-economic and legal aspects of space activities

25. Studies concerning various aspects such as the socio-economic and legal aspects of space activities in the national and international spheres have been taking place for several years. As a result of the studies, among other things, Indonesia has

ratified the Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space (resolution 2345 (XXII), annex), the Convention on International Liability for Damage Caused by Space Objects (resolution 2777 (XXVI), annex) and the Convention on Registration of Objects Launched into Outer Space (resolution 3235 (XXIX), annex). Indonesia has initiated the process of ratification of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (resolution 2222 (XXI), annex), which requires the approval of the Parliament, something that is yet to be obtained. At the executive level, however, the process is almost complete.

7. Regional and international cooperation

26. Regional and international cooperation has been the hallmark of the Indonesian space programme, which endeavours to enhance cooperation with several space agencies and institutions around the world. Indonesia, within available resources, always participates in all main events and meetings of regional and international organizations and initiatives, among others the Committee on the Peaceful Uses of Outer Space, the Regional Space Applications Programme for Sustainable Development (RESAP) in Asia and the Pacific, European Community/Association of South-East Asian Nations (ASEAN) projects, the Subcommittee on Space Applications of the ASEAN Committee on Science and Technology, the Asia-Pacific Regional Space Agency Forum, the Asia-Pacific Network for Global Change Research, the regional Centre for Space Science and Technology Education in Asia and the Pacific, the South-East Asia Regional Committee for the Global Change System for Analysis, Research and Training, the International Geosphere-Biosphere Programme, the Scientific Committee on Solar-Terrestrial Physics, the International Astronautical Federation and the Committee on Space Research.

27. Having been in existence since 1995, RESAP has implemented various activities such as training courses. Since 1995, Indonesia, through Bakosurtanal and the UGM Laboratory for Remote Sensing (PUSPICS) and supported by the United Nations Development Programme, has organized annual medium-term training courses on sustainable land use planning. The training courses have focused on the application of remote sensing data and geographic information systems (GIS) in land use planning. During 2000, Bakosurtanal and PUSPICS/UGM jointly hosted the following training courses: (a) Training Course on the Integrated Use of Remote Sensing and Geographical Information Systems for Coastal Management, held from 28 February to 4 March 2000; and (b) Training Course on the Integrated Use of Remote Sensing and Geographical Information Systems for Land Use Planning, held from 13 November to 13 December 2000. As of 2000, participants from 25 countries of Asia and the Pacific as well as Africa had been trained in Bakosurtanal and PUSPICS/UGM. After receiving approval from the Government of Indonesia, a similar training course is expected to be held in Indonesia in 2001.

Pakistan

A. Provision of satellite data and hardware and software to user institutions in developing countries to initiate or strengthen pilot projects that use Earth observation data for protecting the environment and management of natural resources

1. The Pakistan Space and Upper Atmosphere Research Commission (SUPARCO), as the national coordinator for remote sensing activities in Pakistan, has played and continues to play a pivotal role in promoting the use of satellite remote sensing technology in the country. SUPARCO scientists have carried out a large number of research/demonstration studies addressing a wide variety of resource and environmental problems using satellite remote sensing and geographic information system (GIS) technologies.

2. Since the establishment of a satellite ground station in 1989 in Pakistan, SUPARCO is regularly providing satellite remote sensing data as well as analysis and interpretation services to more than 100 national and international user agencies. A fair amount of remote sensing data prior to the establishment of the satellite ground station is also available in the archives of SUPARCO as historical records data.

3. SUPARCO facilities, such as hardware and software for satellite remote sensing data processing and GIS database development, are available under collaborative arrangements for national user organizations for applications in their projects.

B. Development and implementation of a training module on the use of satellite communications for distance education, telemedicine and tele-health applications

4. Satellite-based telecommunication offers inherent advantages such as distance insensitivity, instantaneous connection, access to remote areas and communities and point-to-multipoint access. For that reason, it has been effectively utilized for new and diverse services and applications such as distance education, telemedicine and tele-health.

1. Distance education

5. The development and maintainance of a good and sophisticated educational institution as well as a qualified teaching cadre is difficult and very costly. However, transmission of training and educational material and conversations with instructors via satellite telecommunication has removed all the difficulties of inaccessibility to remote and isolated communities, the long delays in dispatching and receiving materials and the costs involved. SUPARCO has been contributing actively by developing as well as implementing training modules for distance education. In that regard, SUPARCO developed a store-and-forward communication experiment (SAFE) for exchange of messages and information between any two remote locations. The module was flown on board the Commission's first experimental satellite, BADR-1, launched in July 1990. Small ground terminals were also developed to track the satellite and transmit messages. To demonstrate and to

develop awareness among teachers and students in educational institutions, several open houses, seminars and workshops were organized on the usefulness of the system, especially for distance messaging and education. SUPARCO is also extending cooperation to higher educational institutions by arranging specialized courses on satellite-based telecommunications and their applications on a regular basis. Such training courses are conducted at Karachi and Lahore Universities. In addition, SUPARCO has established an Aerospace Institute in Islamabad for regular training and education of scientists and engineers in the fields of space science and space technology, including telecommunications, information technology and their applications.

6. SUPARCO has also developed an improved version of the SAFE module to be flown on board its second BADR satellite, scheduled for launching in the first quarter of 2001. Small ground terminals are also being developed for participation of the national scientific community and educational institutions in the experiment.

2. Telemedicine/tele-health

7. Through central or regional hook-ups, even the most remote areas can benefit from the medical expertise normally available only in the large urban centres. Through satellite-linked connections remote areas can access support centres where symptoms can be diagnosed and treatment prescribed. The system can make a major contribution to overcoming the shortage of qualified medical professionals. SUPARCO has been arranging short visits of medical students and teachers to its research and development establishments on a regular basis to create awareness of telemedicine and tele-health applications of satellite communications in Pakistan.

Republic of Korea

A. Introduction

1. The main objective of the present annual report is to review briefly the space activities of the Republic of Korea in 2000, including those in the area of space science and technology. The highlight of space activities in 2000 was that the first Korean remote sensing satellite KOMPSAT-1, in successful operation, has begun to provide services for local and overseas users.

2. The Korean space programme covers space communications, satellite development and Earth observation. The key areas of research in space applications, other than space communications, are satellite remote sensing, geographic information systems (GIS) and the Global Positioning System (GPS). Current research activities are undertaken by various organizations, including research institutes and universities. At the national level, the Ministry of Science and Technology, the Ministry of Commerce, Industry and Energy and the Ministry of Information and Communication play central roles in coordinating and implementing space technology policy as well as in funding space development research. At the local level, local authorities conduct research based on satellite information for the development of their communities in the areas of the environment, water resources, forests, fisheries and industry.

B. Satellite programme

3. A new space era has opened recently for the country with ambitious planning for space development. In 2000, four satellites, including two geostationary orbit (GEO) communication satellites, have been successfully operated through the implementation of their missions.

1. KOMPSAT programme

4. The Korea Aerospace Research Institute (KARI) has been developing Korea Multi-purpose Satellite-1 (KOMPSAT-1 or Arirang), a small 510-kg Earth observation satellite with an orbital altitude of 685 km, for five years, together with TRW Inc. of the United States of America. On 20 December 1999, KOMPSAT-1 was successfully launched from Vandenberg Air Force Base, California, United States.

5. KOMPSAT-1 has three mission payloads, a high-resolution electro-optical camera (EOC), an ocean scanning multi-spectral imager (OSMI) and a space physics sensor (SPS). The main mission payload, the EOC, collects panchromatic imagery with a ground sample distance (GSD) of 6.6 metres and a swath width of 17 km by pushbroom scanning. Using the roll-tilt capability of KOMPSAT-1, the EOC can take stereo images that enable the production of digital elevation maps, which can then be used as basic materials for GIS and land development programmes. The primary mission of OSMI is to conduct worldwide ocean colour monitoring and environmental monitoring. It will generate 6-band ocean colour images with a 800-km swath and 1-km GSD by whiskbroom scanning. OSMI is designed to provide in-orbit spectral band selectivity in a spectral range from 400 to 900 nanometres through ground command. SPS consists of a high-energy particle detector (HEPD) and an ionosphere measurement sensor (IMS). The HEPD is intended to characterize the low-altitude high-energy particle environment, while IMS measures densities and temperatures of electrons in the ionosphere. The Republic of Korea started releasing its data for local and overseas users on 1 June 2000 and the data can be used for peaceful purposes.

6. KOMPSAT-1 was the first satellite of the Government of the Republic of Korea for Earth observation. From the success of the KOMPSAT-1 project, the Republic of Korea has laid the national infrastructure related to Earth observation by satellite. Seven companies in the Republic of Korea have been able to acquire the facilities and experts to manufacture Earth observation satellites. KARI has developed the Satellite Integration and Test Centre (SITC), which has the capability to integrate and test 1,000 kg-class satellites. Test facilities at SITC include a 3.6-m thermal vacuum chamber, a 150 kN-class vibration tester and electromagnetic interference (EMI)/electromagnetic compatibility (EMC) test facilities. To control and operate KOMPSAT-1, KARI has also developed a ground station, together with the Electronics and Telecommunications Research Institute, in the Republic of Korea. The ground station facilities consist of S-band and X-band antennas, data storage and processing equipment, satellite operation software, mission analysis and planning software and a satellite simulator. Using the ground station, the satellite image data from KOMPSAT-1 were successfully downloaded and showed the beautiful shape of the Korean peninsula.

7. KARI is now developing KOMPSAT-2, a 700-kg Earth observation satellite with an orbital altitude of 500-800 km. Its orbit will be similar to that of KOMPSAT-1. The main mission of KOMPSAT-2 is GIS image acquisition (panchromatic and multi-spectral) for the Korean region. A multi-spectral camera will be the main payload of KOMPSAT-2, which is now being developed jointly with Elbit System Ltd. in Israel. The camera will be capable of taking photostatic images with 1-m panchromatic visible resolution and 4-m multi-spectral resolution.

2. KAISTSAT-4 programme

8. The fourth small satellite of the Republic of Korea, KAISTSAT-4, is under development under the responsibility of the Satellite Technology Research Centre of the Korea Advanced Institute of Science and Technology (KAIST). The KAISTSAT-4 programme commenced in October 1998 and will be completed in mid-2002.

9. KAISTSAT-4 has been assigned several missions for applications of space science and technology. It carries various space science observation and space engineering test payloads. The aim of its space science missions is to investigate the evolution and spatial distribution of the hot interstellar medium by performing spectral diagnostics in the far ultraviolet range. The space physics of the Earth's polar region will also be studied by simultaneously measuring the populations of charged particles precipitating into the Earth's upper atmosphere. KAISTSAT-4 will deploy a satellite-based data collection system to carry out environment monitoring, wildlife tracking and transportation monitoring. The data collection system is being developed jointly through international cooperation with Australia. One of the main missions of KAISTSAT-4 will be the development and in-orbit testing of a precision star sensor necessary for precise attitude control, which is essential for high-resolution Earth and space observation.

3. KOREASAT programme

10. At the end of 2000, a new broadcasting law, the Integrated Broadcasting Act, was passed by the Culture-Tourism Committee of the National Assembly, and commercial broadcasting services via satellite have commenced in the Republic of Korea under the Act. The Republic of Korea will have high-quality television, telecommunications and Internet service lines using communication satellite technology. The new Act encourages many companies to participate in the Internet service industry via satellite. As the demand on transponders increases, KOREASAT-2 and -3 will play key roles in the future market.

11. Korea Telecom, the owner and operator of KOREASAT-1, has sold the satellite, which has outlived its predicted service life, to Alcatel.

12. The Republic of Korea is considering developing communication satellites additional to the KOREASAT programme. A feasibility study on the local development of a new communication satellite was concluded with the requirement of a spacecraft with a weight of 2,000 kg and power of 3 kW.

C. Space technology applications and space science

1. Space technology applications

13. KOMPSAT-1 has been promoting research and utilization activities in the Republic of Korea remote sensing sector using its data distribution. The following activities have been conducted:

(a) Developing data policy for KOMPSAT-1 data users:

(i) Development of basic plans for data application;

(ii) Development of a KOMPSAT-1 operation plan;

(iii) Identification of methods of data distribution to public and commercial users;

(iv) Development of a pricing policy and related policies;

(b) Forming KOMPSAT-1 data user groups:

(i) Establishing a data distribution system;

(ii) Holding a KOMPSAT-1 workshop for users;

(iii) Contracting with a marketing agency, the Korea Aerospace Industry Ltd. (KAI), for commercial and overseas users;

(c) Establishing an interface between the users and KARI:

(i) Development of a Web site application for KOMPSAT-1 users (see http://kompsat.kari.re.kr and http://krps.kari.re.kr);

(ii) Provision of offices and a software system for external users.

14. The policy on data requires a basic strategy for KOMPSAT-1 data application. The policy's basic objectives are to maximize the use of KOMPSAT-1 data and stimulate a balanced development of public, academic and commercial applications. Domestic user groups can utilize KOMPSAT-1 data for non-commercial, public and research purposes. User groups have to register the name of their organizations when using KOMPSAT-1 data. Commercial and overseas users can purchase KOMPSAT-1 data from KAI, the marketing agency for KOMPSAT-1 data. KAI receives KOMPSAT-1 data from KARI and sells the data to domestic commercial and private users as well as to overseas users. There are now 79 government and public organizations, institutions and universities registered for public and research use.

15. The Republic of Korea carried out an investigation to look into the fields of data application for users during the periods of testing and regular distribution over eight months. Users utilize KOMPSAT-1 data in various different fields depending on the payload. The table below summarizes the users' fields of application. EOC has been applied to land cover classification and cartography, while OSMI has been utilized for calibration/validation of data, atmospheric correction and oceanography.

Table
Users' fields of application of KOMPSAT-1 data based on payloads

Payload	*Data application fields*
Electro-optical camera	Remote sensing, for applications including cartography, analysis of topography, national territory utilization and management, coastal management, disaster monitoring and prevention, environmental monitoring, ocean monitoring, geographical and Earth physics, utilization of agriculture and forestry, development of water resources, development of land and development of software
Ocean scanning multi-spectral imager	Remote sensing, for applications including environmental monitoring, management of coastal zones and harbours, research into ocean currents, vegetation research, development of natural resources, meteorology and software development
Space physics sensor	Research into the ionosphere and the space environment, estimation of the performance of the random access memory and other applications

16. Although KARI distributes stored EOC, OSMI and SPS data in general, it collects and distributes KOMPSAT-1 data with top priority in cases of emergency, including national security emergencies or disasters. During the normal operation of KOMPSAT-1, registered users can acquire KOMPSAT-1 data using the regular procedure.

17. The KOMPSAT Receiving and Processing Station has established an on-line data catalogue search system for KOMPSAT-1 data. Every user of KOMPSAT-1 data can search EOC and OSMI data via the Internet. The catalogue database is maintained by the external browse module server supporting browsing of EOC and OSMI images and related information such as date, time, geographical location, cloud cover and so on. KARI also provides an on-line service for KOMPSAT-1 SPS data. Registered users can acquire SPS data for scientific research and use the file transfer protocol system. KARI is also trying to provide a user-friendly interface system using the World Wide Web and an active server page, which can be made to operate with a simple mouse click.

2. Space science

18. Korean people have a long tradition of celestial observation and searching for the origins of natural phenomena, which have been observed by the astronomical observatory since the fifth century. While it is difficult for most people to understand the benefits from basic science because of its short history, many scientists working in space-related fields in the Republic of Korea are trying to succeed their tradition and to participate in a global effort for the peaceful use of space. Space science research in the Republic of Korea has been carried out by KARI, the Korea Astronomy Observatory, the KAIST Satellite Technology Research Centre and major universities.

19. As satellite and sounding rocket programmes evolved in the 1990s, space science research also became more active in the Republic of Korea. Data analysis of foreign programmes or ground-based observations constitutes a major portion of space science research in the Republic of Korea. The KITSAT series has measured global high-energy particle distribution and the Earth's magnetic fields, while

KOMPSAT-1 carries out global ionospheric measurements as well as high-energy particle experiments. The sounding rocket programmes have also contributed to ionospheric and ozone-layer experiments. This and other research with ultraviolet and X-ray observations is a growing subject for upper atmospheric science and astronomy using satellites and sounding rockets.

20. Space utilization technology and positional astronomy provide information necessary for everyday life and astronomical observation. GPS has already become a popular concept and a differential GPS network is under development as a precise positional reference. Topographic information from the application of GPS will be an additional benefit derived from space technology. Active participation in another international positioning satellite system is being considered.

21. Scientists from the Republic of Korea are now involved in the research programme of the National Aeronautics and Space Administration of the United States to explore international collaboration in space science and applications. One example would encompass participation in the Advanced Cosmic-ray Composition Experiment for the Space Station (ACCESS) on board the International Space Station for cosmic ray research.

United Kingdom of Great Britain and Northern Ireland

Printed information on space activities in the United Kingdom of Great Britain and Northern Ireland will be distributed during the forty-fourth session of the Committee on the Peaceful Uses of Outer Space, from 6 to 15 June 2001.